The first 6 pixels

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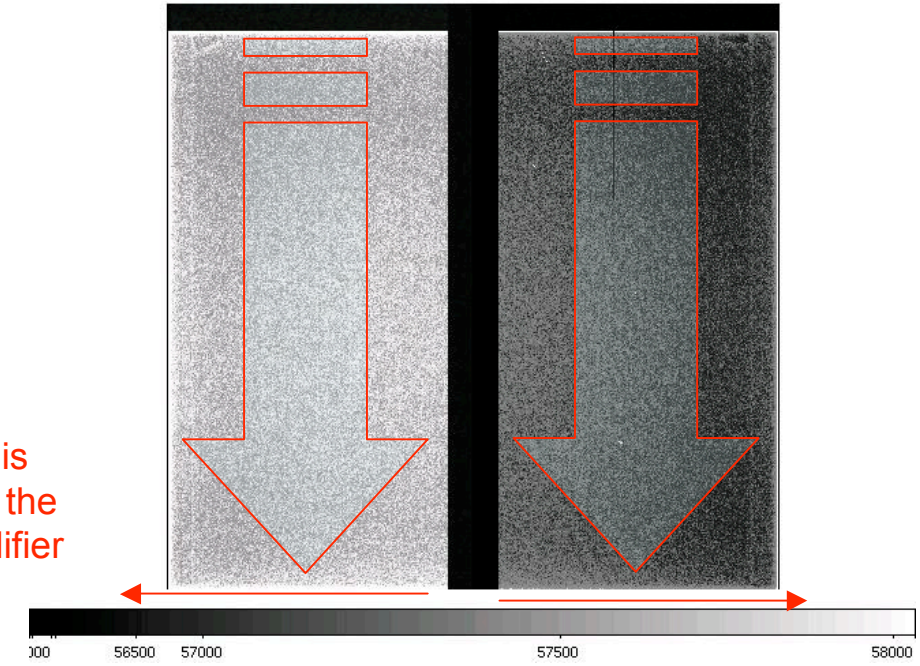
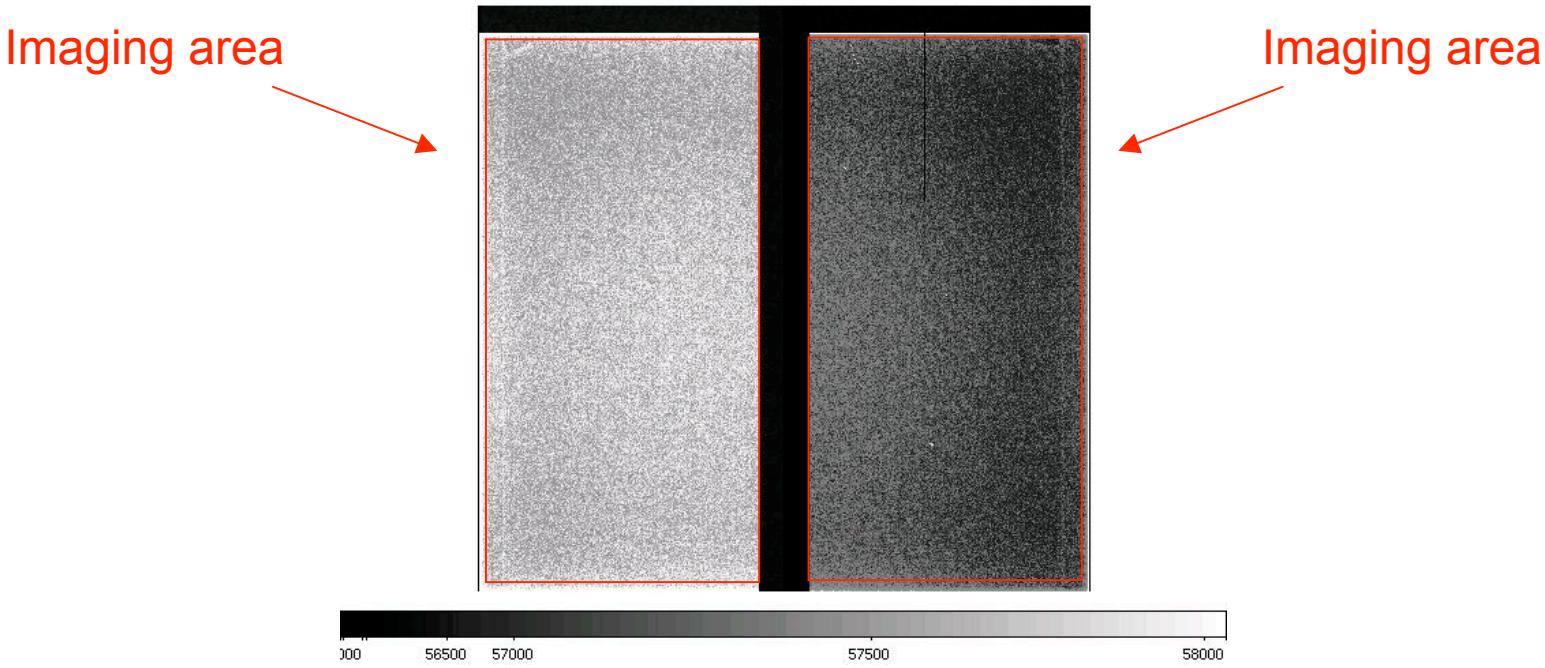
Readout of a DES CCD image

The rows are shifted down, one by one, into the serial register

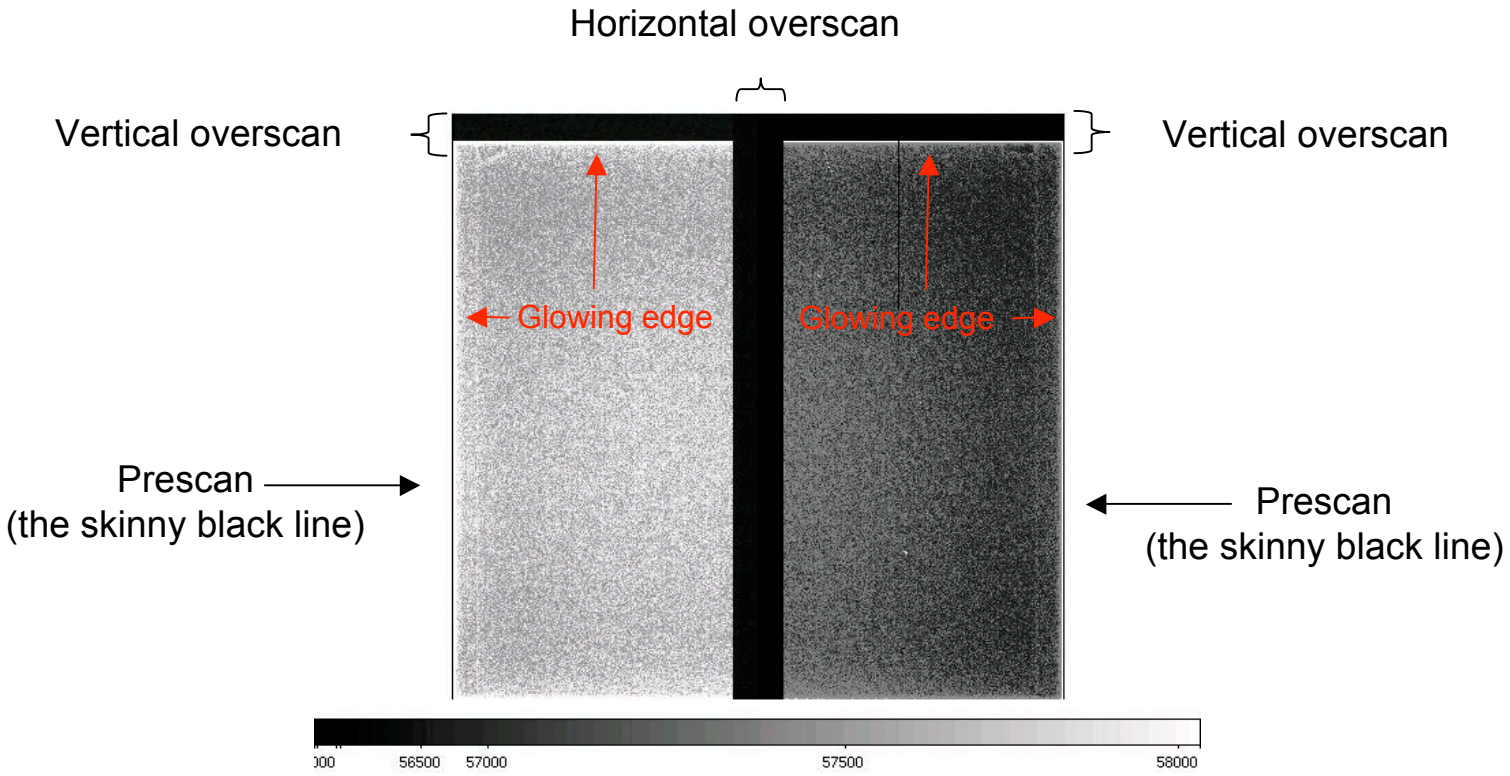
The charge in each pixel is shifted horizontally along the serial register to the amplifier



Regions of a DES CCD image

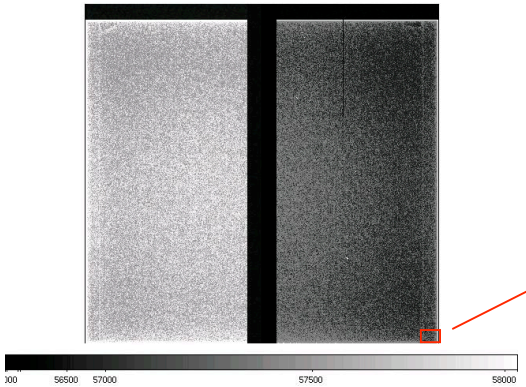


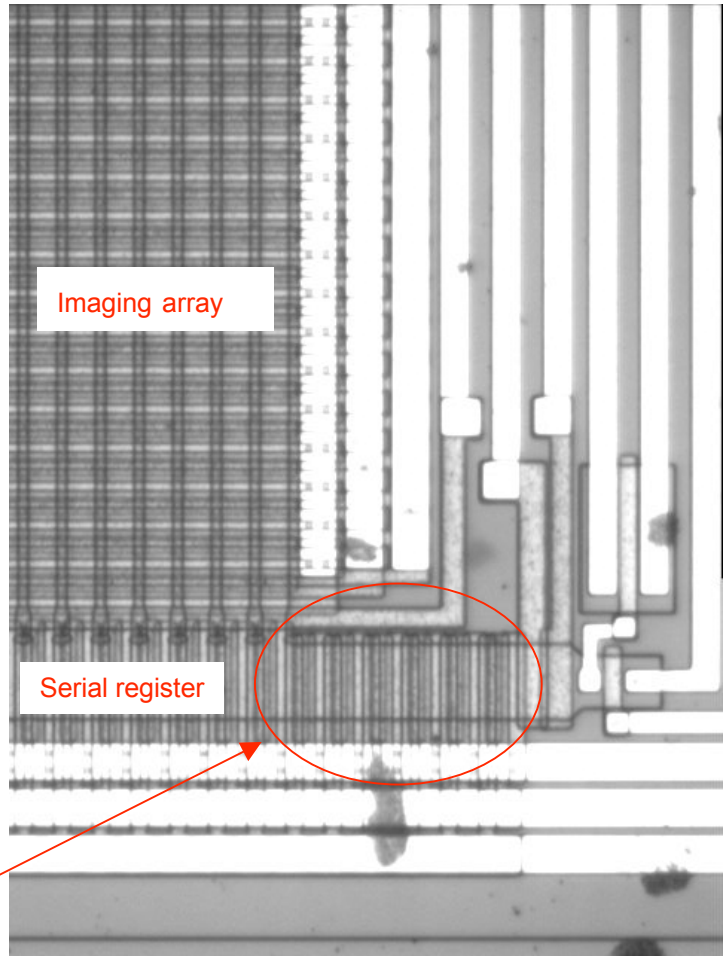
Regions of a DES CCD image



Non-imaging pixels

- There are 2 categories of *non-imaging pixels* in DES fits images: *overscan* and *prescan*
  - *Overscan* is created by overclocking the horizontal (serial) register.
    - These pixels do *not* correspond to any physical pixels on the CCD
  - *Prescan* is created when the 6 pixels between the edge of the imaging array and the on-chip amplifier are read out.
    - These *are* physical pixels on the CCD





700x image courtesy Gordie Gillespie, SiDet CMM

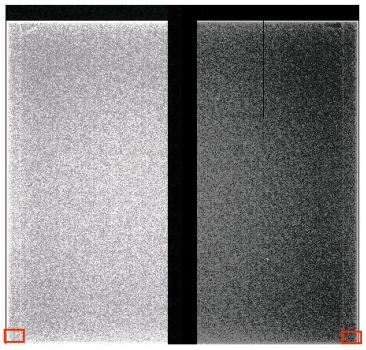
Terminology

- These 2 categories of non-imaging pixels have various names in the literature.
- I'll use "prescan" and "overscan"

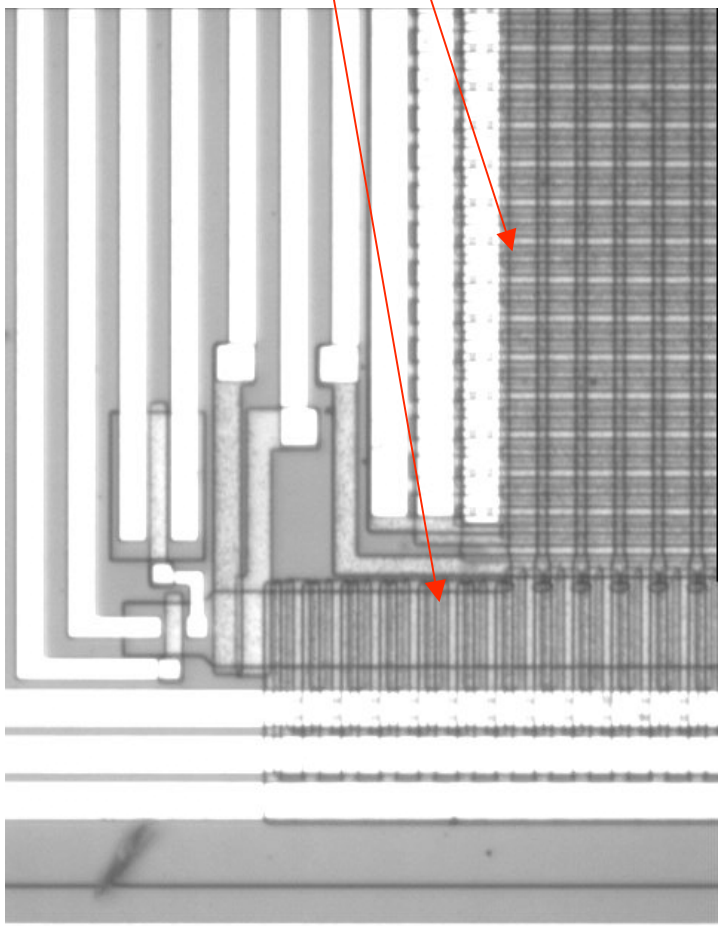
DES	prescan	overscan
SDSS, Gunn, et al	"extended pixels"	overscan
HST	physical overscan	virtual overscan
Janesick	extended pixels	extended pixels

- Janesick: "Extended pixels are found at the beginning of a line or are purposely created by overclocking the horizontal register."

Structures on the DES CCD



3 gates/pixel for 3 phase transfer

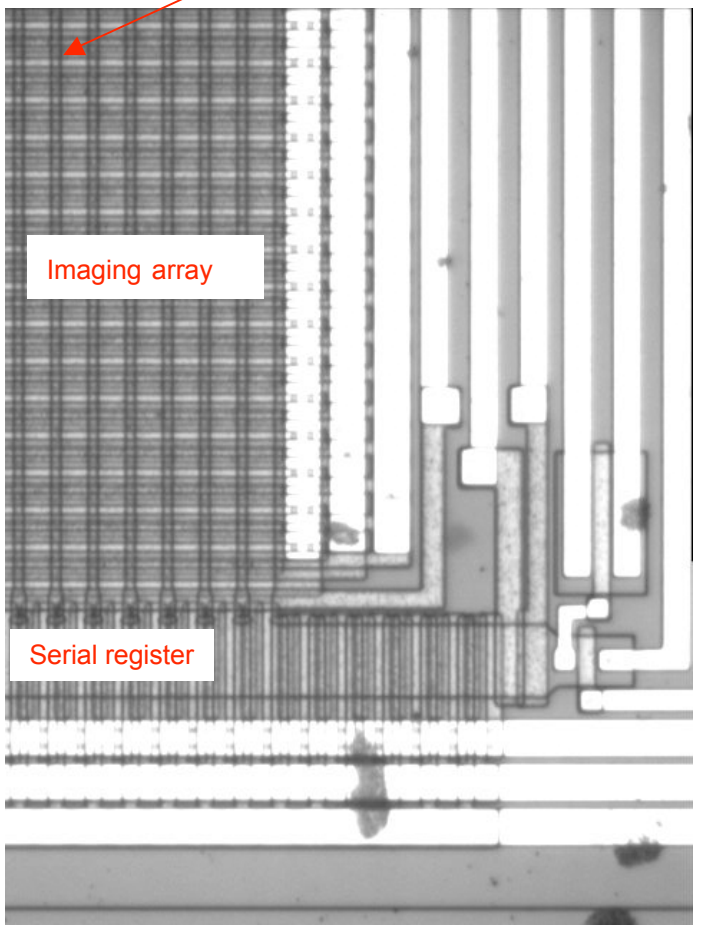


Channel stops

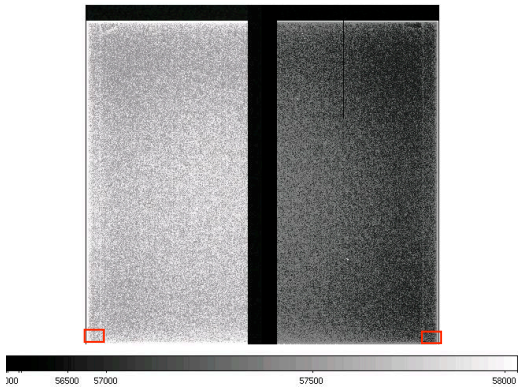
Voltage buses

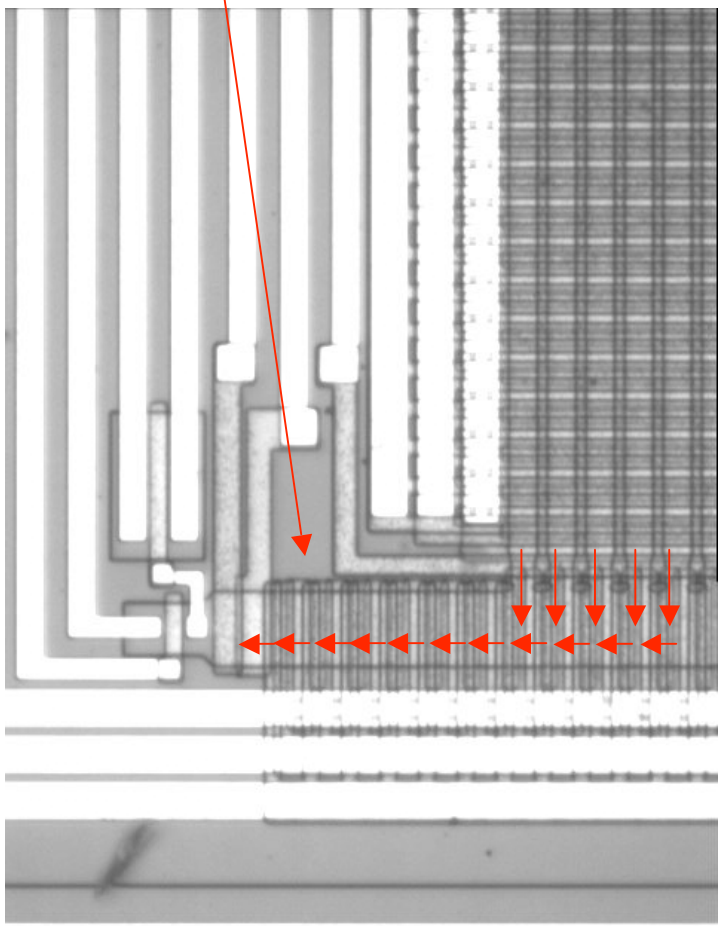
Imaging array

Serial register

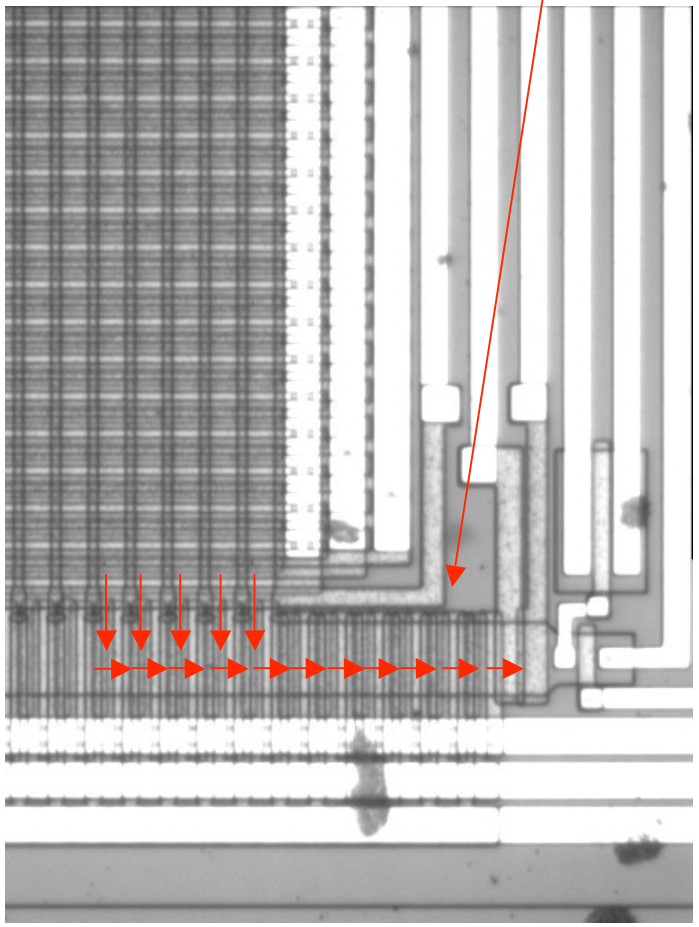


The skinny line of prescan is generated by these 6 pixels

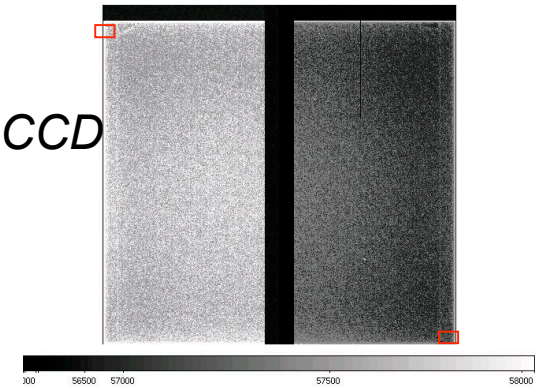


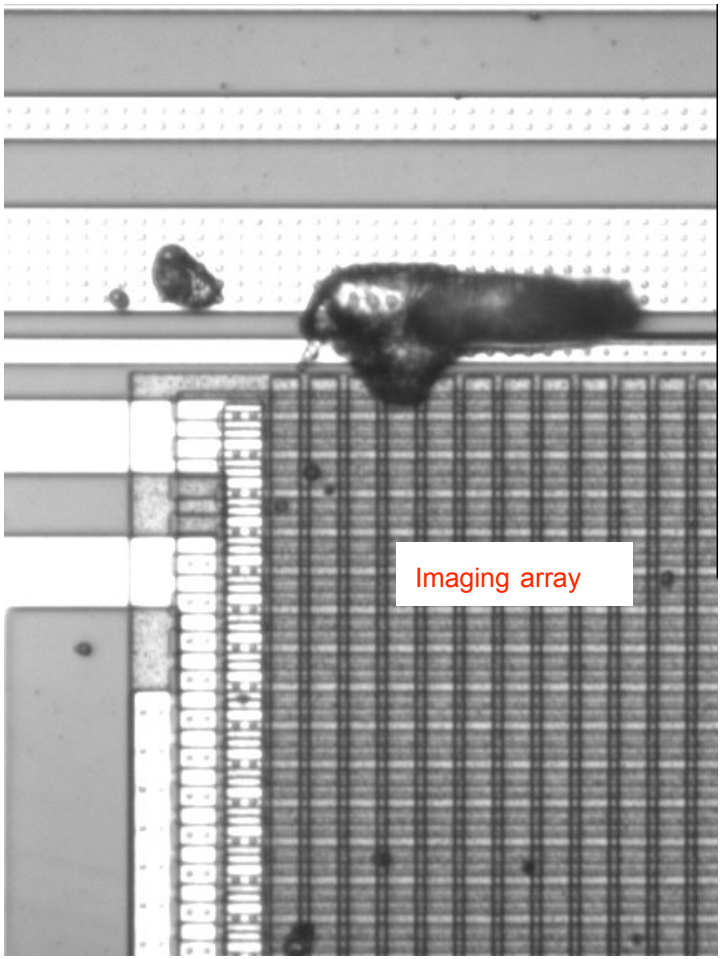


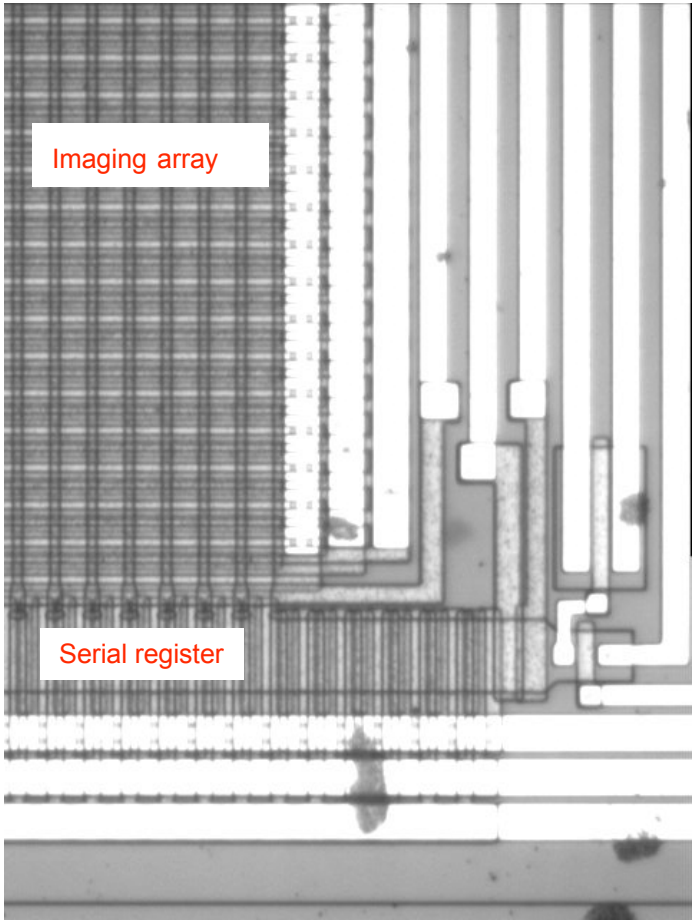
The skinny line of prescan is generated by these 6 pixels



More structures on the DES CCD





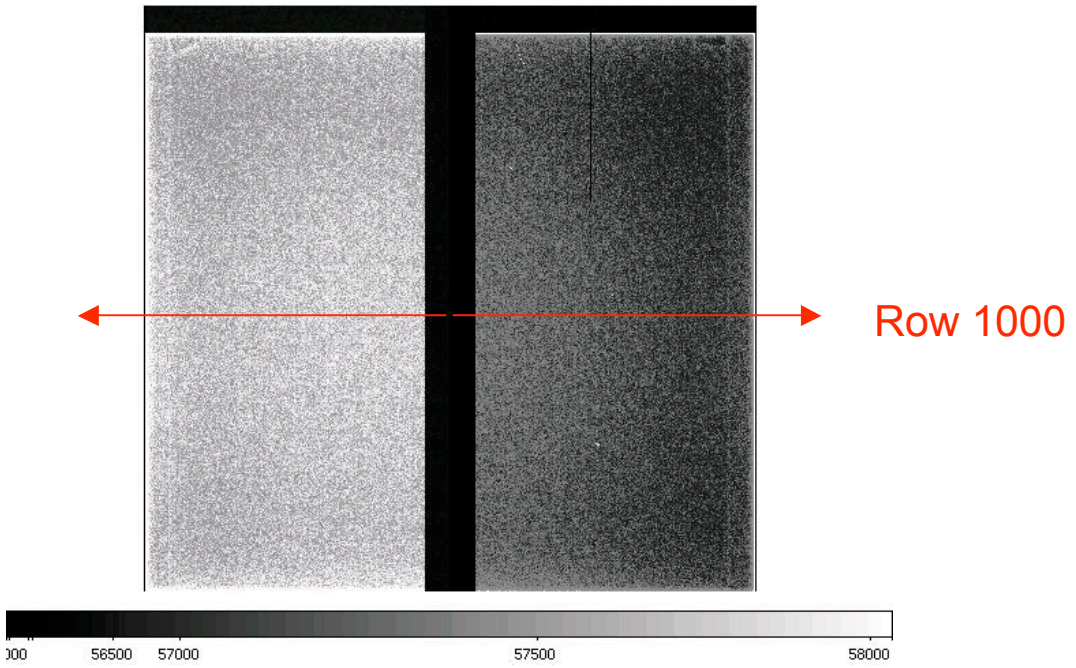


Prescan signal

- To study what the prescan signals look like in detail, we plotted ADU vs. column number for an arbitrarily chosen row (Row 1000) of 5 2k x 2k CCDs.

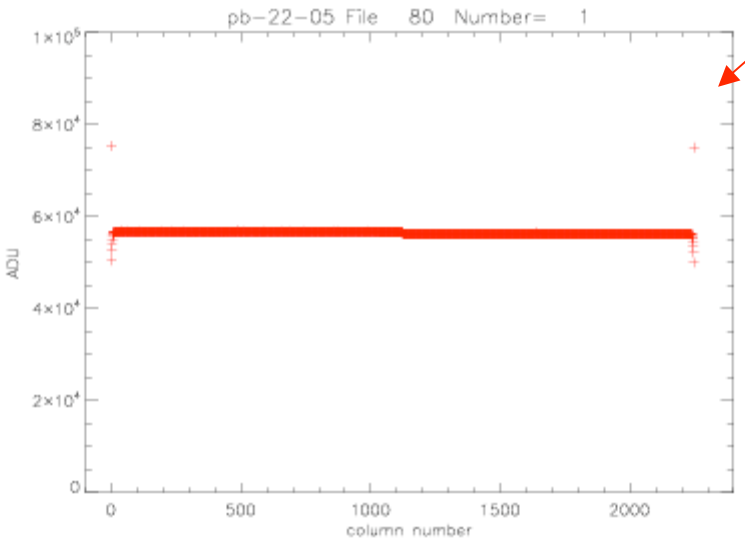
- First shown are the plots across the entire array of one of these 5 CCDs, then we zoom-in on the last few pixels.

- We compare dark and 30-second exposures

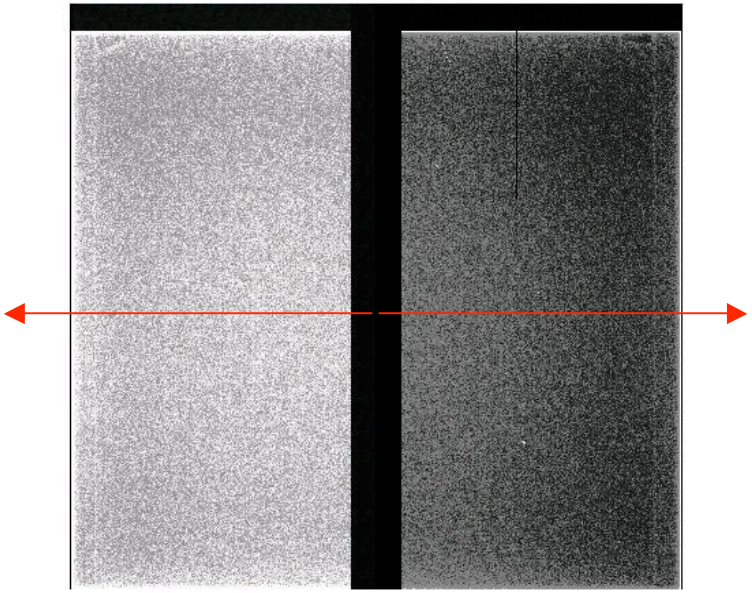


Exposure time = 0 s

Prescan



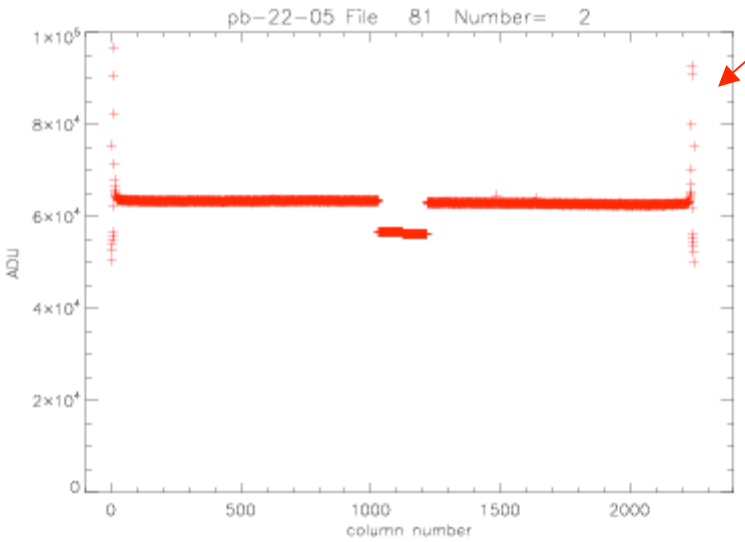
Row 1000



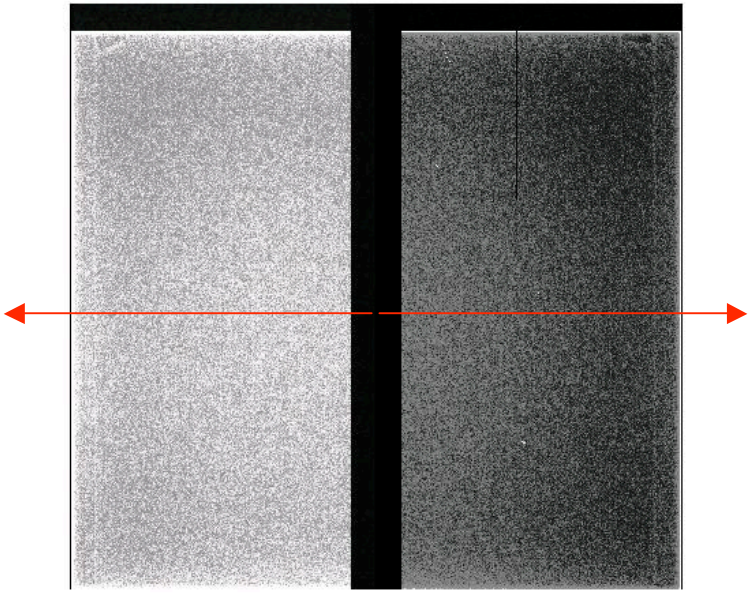
Row 1000

Exposure time = 30 s

Prescan + glowing edge



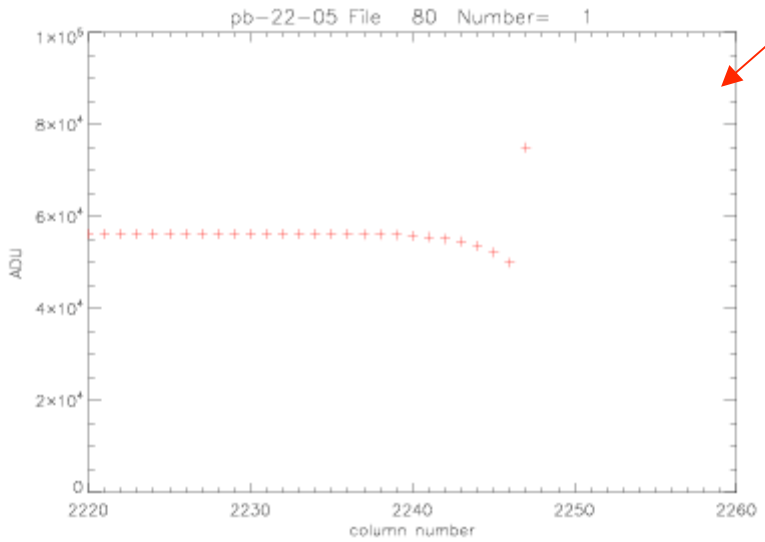
Row 1000



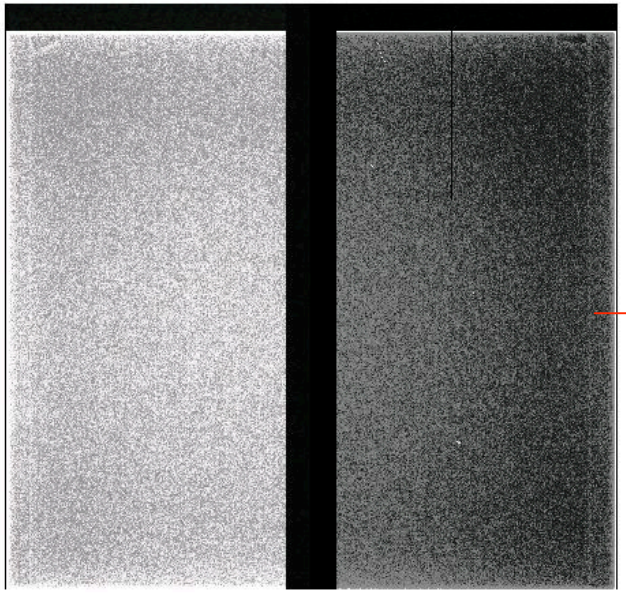
Row 1000

Exposure time = 0 s

Prescan



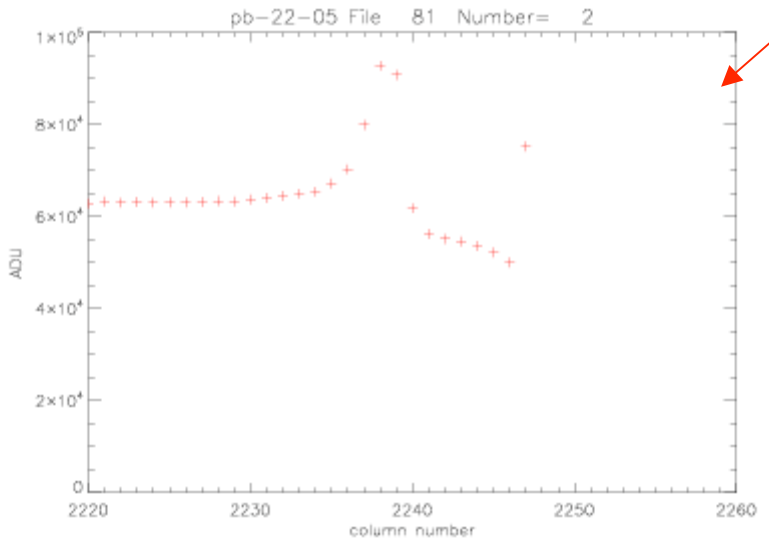
Row 1000



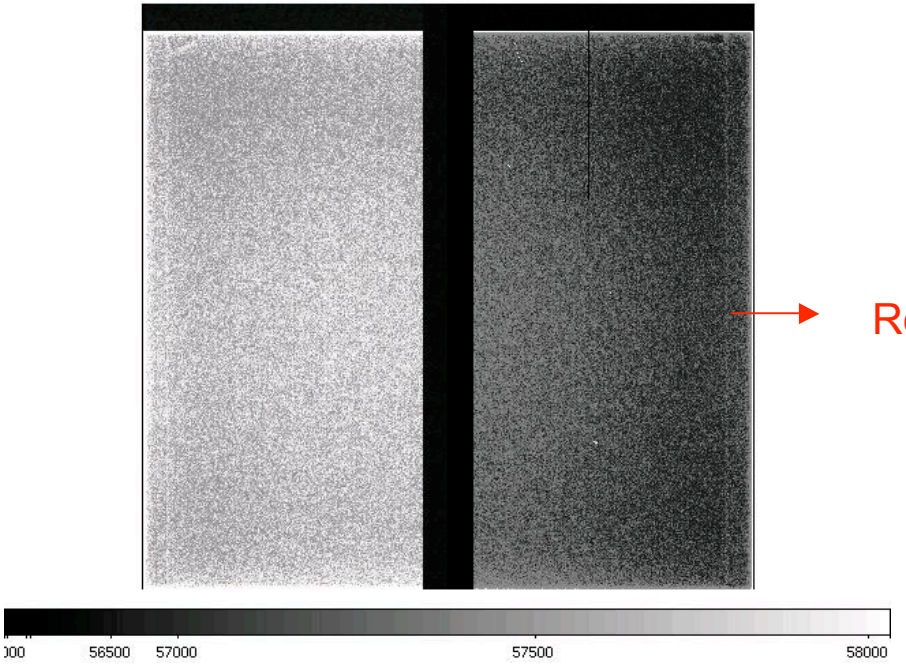
Row 1000

Exposure time = 30 s

Prescan + glowing edge



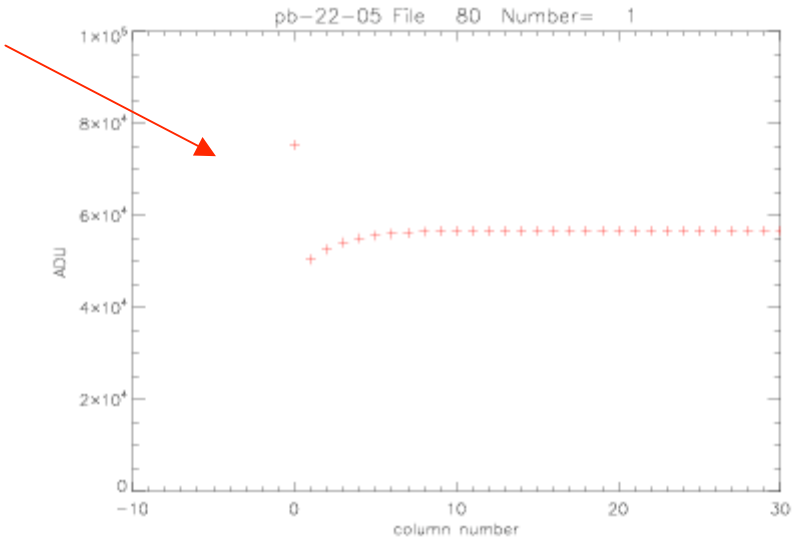
Row 1000



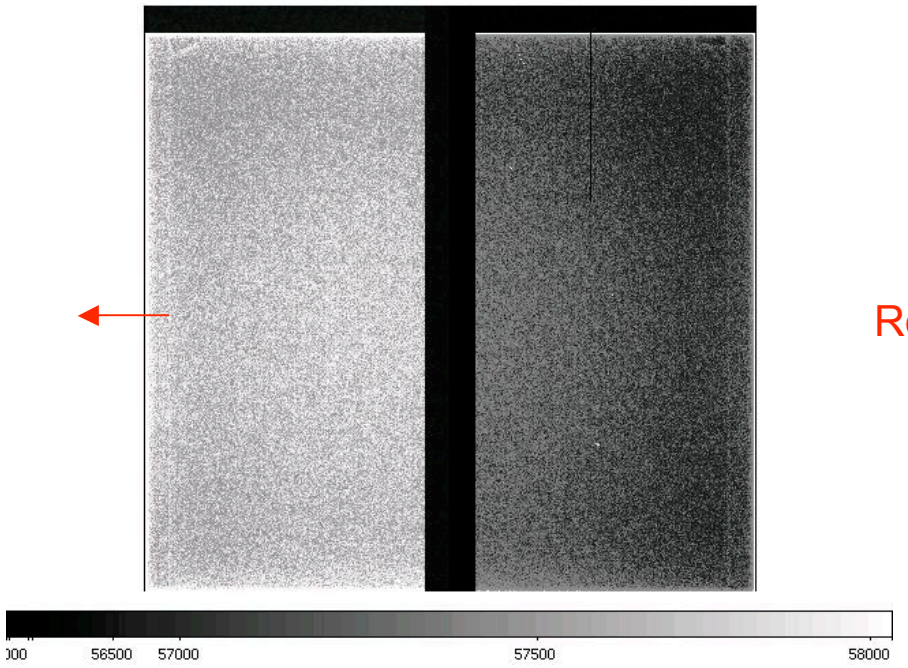
Row 1000

Exposure time = 0 s

Prescan



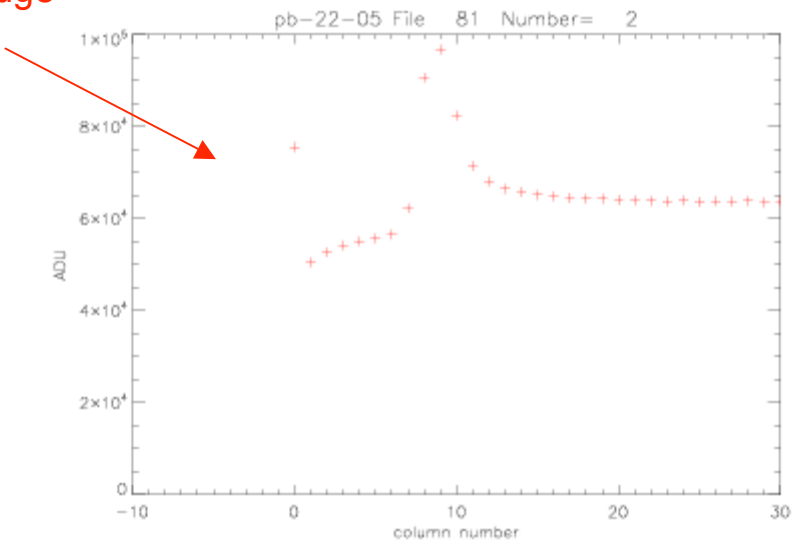
Row 1000



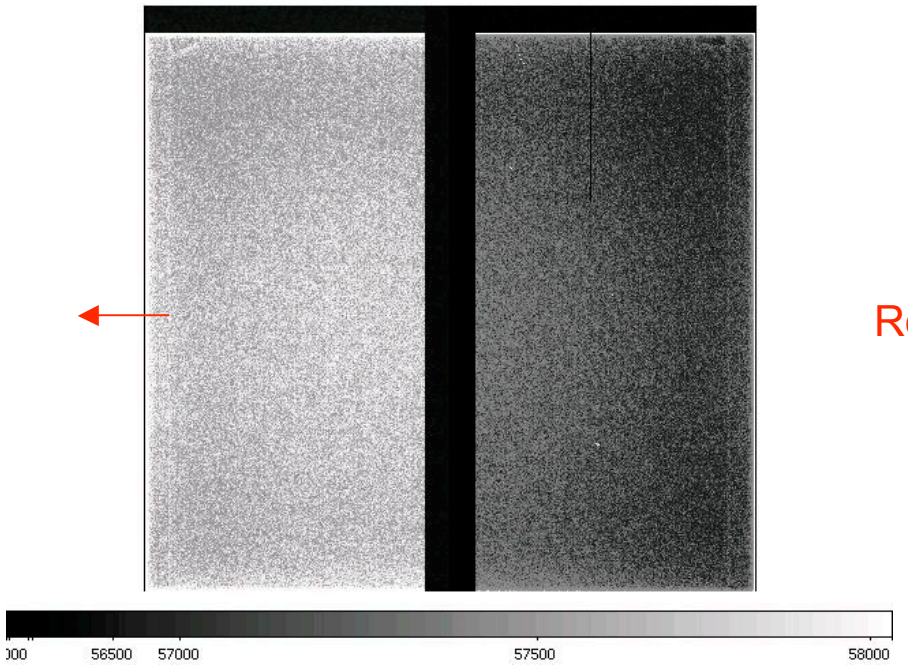
Row 1000

Exposure time = 30 s

Prescan + glowing edge



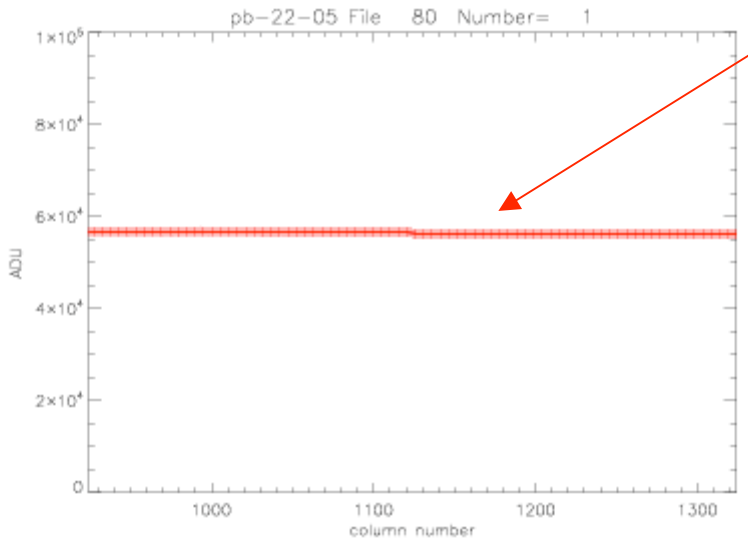
Row 1000



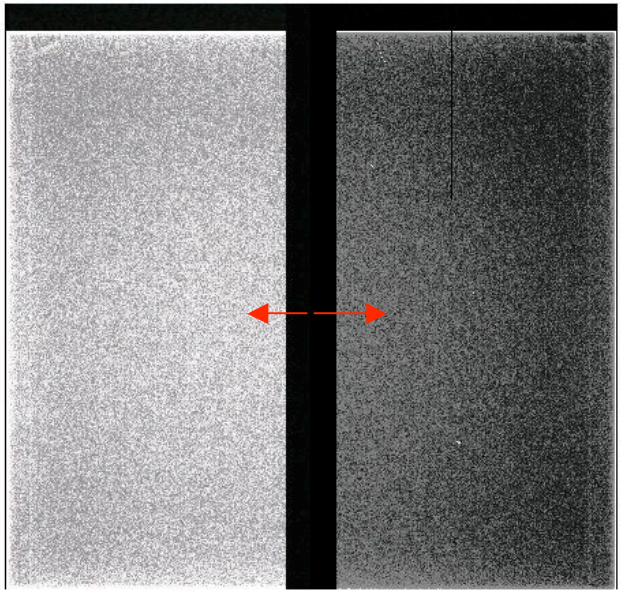
Row 1000

Exposure time = 0 s

Horizontal Overscan



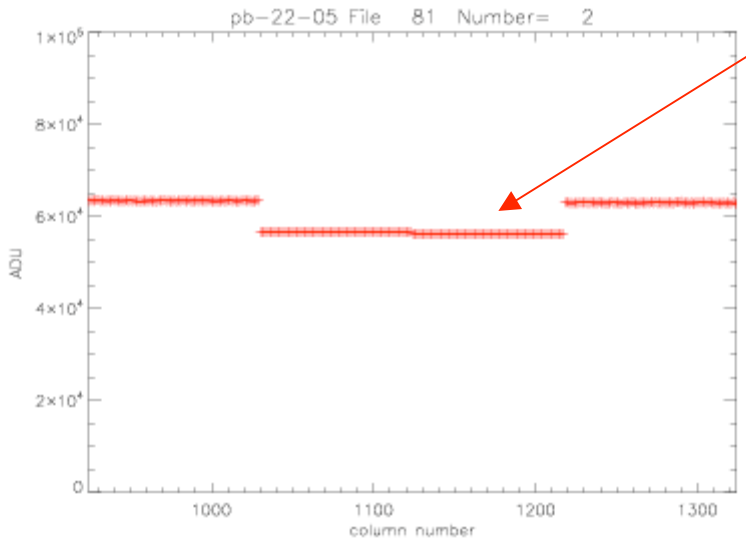
Row 1000



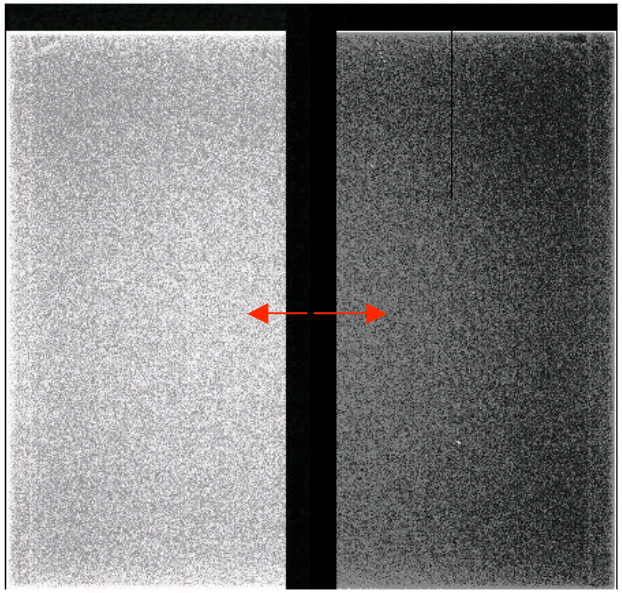
Row 1000

Exposure time = 30 s

Horizontal Overscan



Row 1000



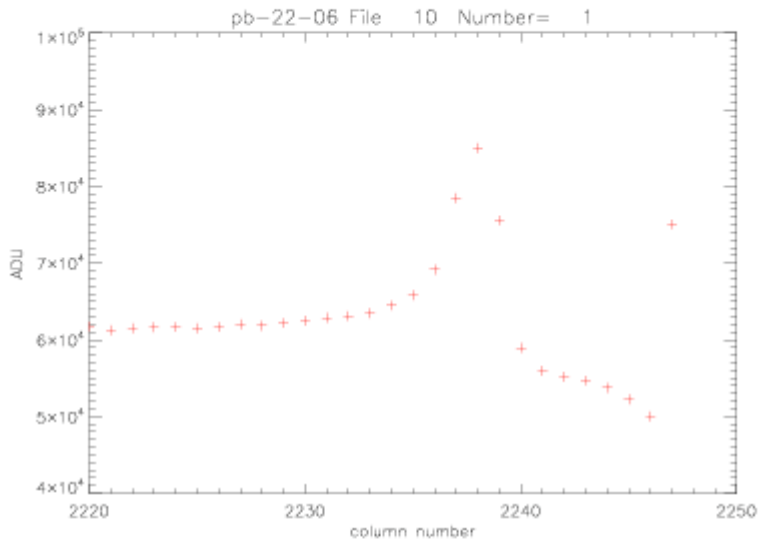
Row 1000

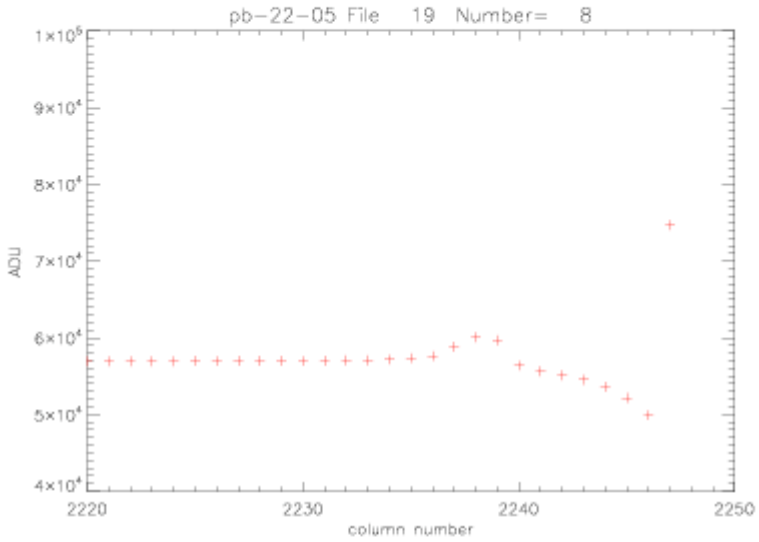
Prescan signal

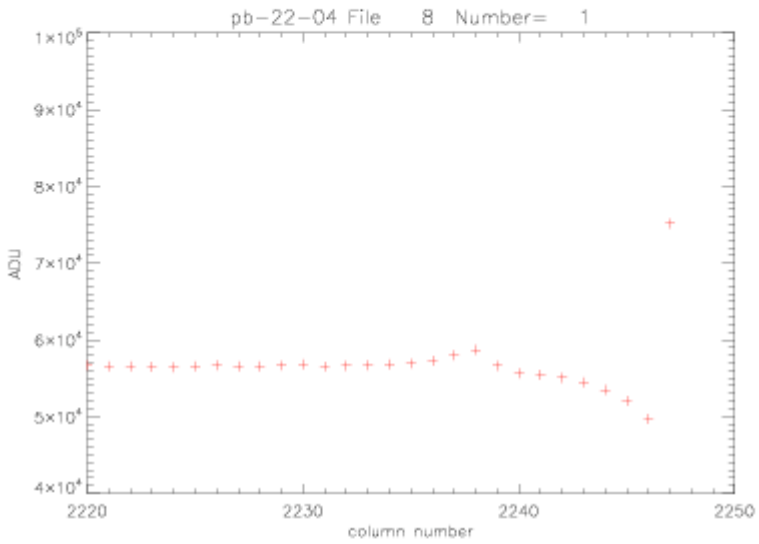
- The prescan signal is constant for fixed H and V gate voltages.
- It is not f(exposure time)
- It is f(clock voltage), which was seen in data from other characterization test data
- It is not f(Lot); at first it seemed like it might be, because the first 3 CCDs plotted were from the same lot and had identical prescan signals.
- However, the 4th CCD plotted from the same lot was different, as was the 5th CCD which was from a different lot

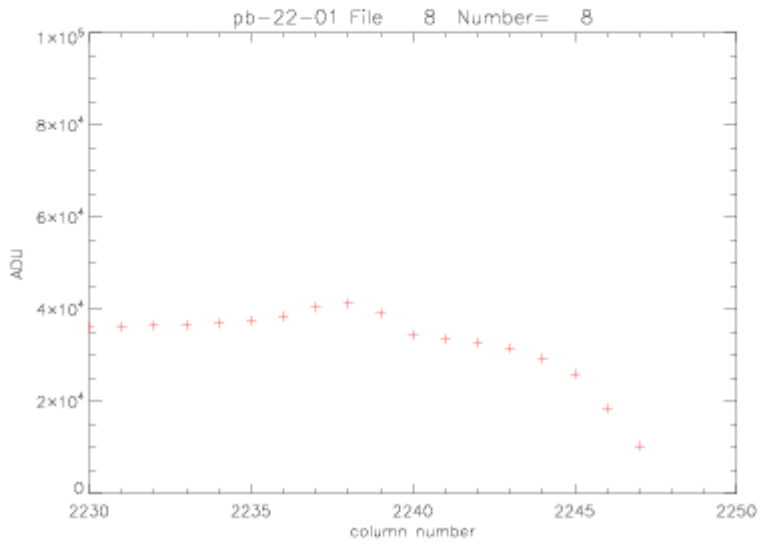
CCD	Lot	Date of Fulltest
pb-22-06	1B	28-Nov-06
pb-22-05	1B	3-Nov-06
pb-22-04	1B	24-Oct-06
pb-22-03	1B	9-Oct-06
pb-22-01	1A	24-Mar-06

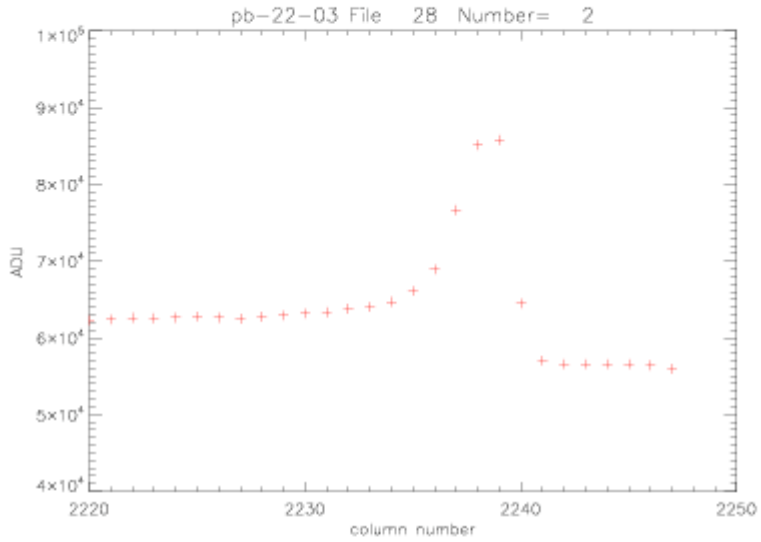
The next 5 images show the prescan signal
for each of the 5 CCDs
(note, the exposure time is not the same for each image)


pb-22-06 File 10 Number= 1
1×10^5
9×10^4
8×10^4
7×10^4
6×10^4
5×10^4
4×10^4
ADU
2220
2230
2240
2250
column number


pb-22-05 File 19 Number= 8
1×10^5
9×10^4
8×10^4
7×10^4
6×10^4
5×10^4
4×10^4
ADU
2220
2230
2240
2250
column number


pb-22-04 File 8 Number= 1
1×10^5
9×10^4
8×10^4
7×10^4
6×10^4
5×10^4
4×10^4
ADU
2220
2230
2240
2250
column number


pb-22-01 File 8 Number= 8
1x10^5
8x10^4
6x10^4
4x10^4
2x10^4
0
ADU
2230
2235
2240
2245
2250
column number


pb-22-03 File 28 Number= 2
1×10^5
9×10^4
8×10^4
7×10^4
6×10^4
5×10^4
4×10^4
ADU
2220
2230
2240
2250
column number

Questions for further study

- Why 6 prescan pixels?
  - For example, SDSS CCDs have 20 prescan (“extended”) pixels
- What function do the prescan pixels provide?
  - Allow electronics to ‘relax’ before reading out the next row of pixels after moving next row into the serial register?
- How is the output of the prescan pixels f(clock voltages) & other parameters?